

# Alabama Building Energy



## Conservation Code 2004

STATE OF ALABAMA  
BUILDING COMMISSION  
Kippy Tate, AIA, Director

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## FOREWORD

The 2004 version of the Alabama Building Energy Conservation Code (ABECC) is based on ASHRAE 90.1-2001. The text has been modified to comply with Alabama's climatic conditions and to reflect the consensus opinions of the Alabama Building Commission. The following sections of ASHRAE 90.1-2001 are included by reference only.

Section 3	Definitions
Section 6	HVAC Equipment
Section 10	Other Equipment
Section 11	Energy Cost Budget Method
Appendix A	Assembly U-Factor, C-Factor and F-Factor Determination
Appendix B	Building Envelope Criteria
Appendix C	Methodology for Building Envelope Trade-Off Option in Subsection 5.4
Appendix D	Climatic Data
Appendix E	Informative References
Appendix F	Addenda

The *Mandatory* sections of ASHRAE 90.1-2001 must be satisfied for all buildings in accordance with the scope of this code. A entirely prescriptive compliance path is available to designers. Project checklists which are part of the "Compliance Documents" may be found in Appendix A of ABECC.

A computer analysis is no longer *required*, but computer analyses can be used in two ways (1) A program such as ENVSTD or COMCheck can be used to evaluate "Trade-Offs" on the building envelope, and (2) the Energy Cost Budget Method requires an hour-by-hour computer analysis of the building.

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**OFFICIAL NOTICE**

**ALABAMA BUILDING ENERGY CONSERVATION CODE**  
**APPLICABLE TO ALL NEW AND RENOVATED BUILDINGS**

**GENERAL**

Pursuant to CODE OF ALABAMA, Section 41-9-174, The Alabama Building Energy Conservation Code (ABECC) was adopted by the Building Commission on 2 December, 1982 after having been recorded in the Office of the Secretary of State or as otherwise required by state law. Revisions to the Code were adopted by the Building Commission on 1 August, 1984, 31 July, 1994, and 1 January 2005. The latest version of the Code shall become a part of the Building Commission review and approval process for all state funded and/or operated building types including public school buildings which require the approval of the Building Commission. ABECC-2004 is based on the International Energy Conservation Code in which commercial buildings are covered by Chapter 7 of the IECC. Chapter 7 of the IECC states that "Commercial buildings shall meet the requirements of ASHRAE/IESNA 90.1". ABECC-2004 is based on the 2001 version of ASHRAE/IESNA 90.1; excerpts are contained herein.

## **1. PURPOSE**

The purpose of ABECC is to provide minimum requirements for the energy efficient design of buildings which fall under the jurisdiction of the Alabama Building Commission.

## **2. SCOPE**

### **2.1 This standard provides**

- a.** minimum energy efficient requirements for the design and construction of
  - (1) new buildings and their systems,
  - (2) new portions of buildings and their systems, and
  - (3) new systems and equipment in existing buildings and
- b.** criteria for determining compliance with these requirements.

### **2.2 The provisions of this standard apply to**

- a.** the envelope of buildings, provided that the enclosed spaces are
  - (1) heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h-ft<sup>2</sup> or
  - (2) cooled by a cooling system whose sensible output capacity is greater than or equal to 5 Btu/h-ft<sup>2</sup>, and
- b.** the following systems and equipment used in conjunction with the buildings:
  - (1) heating, ventilating and air conditioning,
  - (2) service water heating,
  - (3) electric power distribution and metering provisions,
  - (4) electric motors and belt drives, and
  - (5) lighting.

### **2.3 The provisions of this standard do not apply to**

- a.** single family houses, multi family structures of three stories or fewer above grade, manufactured houses (mobile homes) and manufactured houses (modular),
- b.** buildings that do not use either electricity or fossil fuel, or
- c.** equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial processes.

**2.4** Where specifically noted in this standard, certain other buildings or elements of buildings shall be exempt.

**2.5** This standard shall not be used to circumvent any safety, health, or environmental requirements.

## **3. DEFINITIONS**

**Refer to ASHRAE 90.1-2001.**

## **4. ADMINISTRATION AND ENFORCEMENT**

### **4.1 Compliance Requirements**

**4.1.1 New Buildings.** New buildings shall comply with either the provisions of Sections 5, 6, 7, 8, 9, and 10, or Section 11. New buildings of less than 4000 square feet of floor area shall comply with the General and Mandatory provisions of Sections 5, 6, 7, 8, 9 and 10.

**4.1.2 Existing Buildings.** Additions to existing buildings shall comply with either the provisions of Sections 5, 6, 7, 8, 9, and 10 or Section 11, as described in 4.1.2.1. Alterations of existing buildings shall comply with either the provisions of Sections 5, 6, 7, 8, 9, and 10, or Section 11, as described in 4.1.2.2, provided, however, that nothing in this standard shall require compliance with any provision of this standard if such compliance will result in an increase in the annual energy consumption of the building. Additions to existing buildings of less than 4000 square feet of floor area shall comply with the General and Mandatory provisions of Sections 5, 6, 7, 8, 9 and 10.

**4.1.2.1 Additions to Existing Buildings.** An extension or increase in floor area or height of a building outside of the existing building envelope shall comply with the provisions of Sections 5,6,7,8,9, and 10, applicable to building envelope, heating, ventilating, air-conditioning, service water heating, power, lighting, and other systems and equipment. Alternatively, additions shall comply with the provisions of Section 11.

#### **Exceptions to 4.1.2.1:**

- (a) When HVAC or service water heating to an addition is provided by existing HVAC or service water heating systems and equipment, such existing systems and equipment shall not be required to comply with this standard. However, any new systems or equipment installed must comply with specific requirements applicable to those systems and equipment.
- (b) When an addition to an existing building cannot comply by itself, trade-offs will be allowed by modification to one or more components of the existing building. Modeling of the modified components of the existing building and the addition shall employ the procedures of Section 11; and the addition shall not increase the energy consumption of the existing building plus the addition beyond the energy that would be consumed by the existing building plus the addition if the addition alone did comply.

**4.1.2.2 Alterations to Existing Buildings.** Portions of a building envelope, heating, ventilating, air-conditioning, service water heating, power, lighting, and other systems and equipment that are being replaced shall comply with the applicable requirements of Sections 5, 6, 7, 8, 9, and 10 as provided in 4.1.2.2.1 through

4.1.2.2.6.

**Exceptions to 4.1.2.2:**

- (a) A building that has been specifically designated as historically significant by the Alabama Building Commission or is listed in “The National Register of Historic Places” or has been determined to be eligible for listing by the U.S. Secretary of the Interior need not comply with these requirements.
- (b) Where one or more components of an existing building or portions thereof is being replaced, the annual energy consumption of the comprehensive proposed design shall not be greater than the annual energy consumption of a substantially identical design, using the same energy types, in which the individual components comply with the applicable requirements of Sections 5, 6, 7, 8, 9, and 10 as provided in 4.1.2.2.1 through 4.1.2.2.6, and such compliance is verified by a design professional, by the use of any calculation methods acceptable to the Alabama Building Commission.

**4.1.2.2.1 Envelope Alterations.** Alterations to the building envelope shall comply with the requirements of Section 5 for insulation, moisture control, air leakage, and fenestration applicable to those specific portions of the building that are being altered.

Exceptions to 4.1.2.2.1: The following alterations need not comply with these requirements, provided such alterations will not increase the energy usage of the building:

- (a) installation of storm windows over existing glazing,
- (b) replacement of glazing in existing sash and frame provided the U-factor and SHGC will be equal to or lower than before the glass replacement,
- (c) alterations to roof/ceiling, wall, or floor cavities, which are insulated to full depth with insulation having a minimum nominal value of R-3.0/in.,
- (d) alterations to walls and floors, where the existing structure is without framing cavities and no new framing cavities are created, or
- (e) replacement of a roof membrane where either the roof sheathing or roof insulation is not exposed or, if there is existing roof insulation, below the roof deck,
- (f) replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a conditioned space from the exterior shall not be removed, and

- (g) replacement of existing fenestration, provided, however, that the area of the replacement fenestration does not exceed 25% of the total fenestration area of an existing building and that the U-factor and SHGC will be equal to or lower than before the fenestration replacement.

**4.1.2.2.2 Heating, Ventilating, and Air-Conditioning Alterations.** New HVAC equipment as direct replacement of existing HVAC equipment shall comply with the specific minimum efficiency requirements applicable to that equipment, including, but not limited to, air conditioners and condensing units, heat pumps, water chilling packages, packaged terminal and room air conditioners and heat pumps, furnaces, duct furnaces, unit heaters, boilers, and cooling towers. New cooling systems installed to serve previously un-cooled spaces shall comply with Section 6 of ASHRAE 90.1-2001. Alterations to existing cooling systems shall not decrease economizer capability unless the system complies with Section 6 of ASHRAE 90.1-2001. New and replacement ductwork and piping shall comply with Section 6 of ASHRAE 90.1-2001.

**Exceptions to 4.1.2.2.2:** Compliance shall not be required:

- (a) for equipment that is being modified or repaired but not replaced, provided that such modifications and/ or repairs will not result in an increase in the annual energy consumption of the equipment using the same energy type, or
- (b) where a replacement or alteration of equipment requires extensive revisions to other systems, equipment, or elements of a building, and such replaced or altered equipment is a like-for-like replacement, or
- (c) for a refrigerant change of existing equipment, or
- (d) for the relocation of existing equipment, or
- (e) for ducts and pipes where there is insufficient space or access to meet these requirements.

**4.1.2.2.3 Service Water Heating Alterations.** Building service water heating equipment installed as a direct replacement for existing building service water heating equipment shall comply with the requirements of Section 7 applicable to the system being replaced. New and replacement piping shall comply with 7.2.3

**Exception to 4.1.2.2.3:** compliance shall not be required where there is insufficient space or access to meet these requirements.

**4.1.2.2.4 Power Alterations.** Building electrical systems that are replaced shall comply with the requirements of Section 8, applicable to those specific portions of the building and its electrical systems that are being replaced.

**4.1.2.2.5 Lighting Alterations.** The replacement of lighting systems in any building space shall comply with the lighting power density requirements of Section 9 applicable to that space. New lighting systems shall comply with the applicable lighting power density requirements of Section 9. Any new control devices as a direct replacement of existing control devices shall comply with the specific requirements of 9.2.1.2(a) and 9.2.1.2(c).

**Exception to 4.1.2.2.5:** Alterations that replace less than 50% of the luminaries in a space need not comply with these requirements provided that such alterations do not increase the installed interior lighting power.

**4.1.2.2.6 Other Equipment Alterations.** Alterations to other building equipment or systems shall comply with the requirements of Section 10 applicable to those specific portions of the building and its systems that are being altered. Any new equipment subject to the requirements of Section 10 that is installed in conjunction with the alterations as a direct replacement of existing equipment or control devices shall comply with the specific requirements applicable to that equipment or control devices provided, however, that compliance shall not be required for the relocation or reuse of existing equipment.

**4.1.2.3 Changes in Space Conditioning.** Whenever unconditioned spaces in a building are converted to conditioned spaces, such conditioned spaces shall be brought into compliance with all applicable requirements of this standard that would apply to the building envelope, heating, ventilating, air-conditioning, service water heating, power, lighting, and other systems and equipment of the space as if the building were new.

**4.2 Administrative Requirements.** Administrative requirements relating to the enforcement by the Alabama Building Commission, locally adopted energy standards, interpretations, claims of exemption, and rights of appeal are specified by the Alabama Building Commission.

## **4.3 Compliance Documents**

**4.3.1 General.** Compliance documents are those plans, specifications, engineering calculations, checklists, diagrams, reports, and other data that are approved as part of the review process by the Alabama Building Commission.

**4.3.2 Construction Details.** Compliance documents shall show all pertinent data and features of the building, equipment, and systems in sufficient detail to permit a determination of the compliance by the Alabama Building Commission and to



indicate compliance with the requirements of this standard.

**4.3.3 Supplemental Information.** Supplemental information necessary to verify compliance with this standard, such as calculations, worksheets, compliance forms, vendor literature, or other data, shall be made available when required by the Alabama Building Commission.

#### **4.4 Labeling of Materials and Equipment**

**4.4.1 General.** Materials and equipment shall be labeled in a manner that will allow for a determination of their compliance with the applicable provisions of this standard.

**4.4.2 Fenestration.** The U-factor, SHGC, and air leakage rate for all manufactured fenestration products shall be identified on a permanent nameplate installed on the product by the manufacturer. Alternatively, when fenestration products do not have such nameplate, the installer or supplier of such fenestration shall provide a signed and dated certification for the installed fenestration listing the U-factor, SHGC, and air leakage rate.

**4.4.3 Doors.** The U-factor and the air leakage rate for all manufactured doors installed between conditioned space, unconditioned space, and exterior space as outlined in 5.1.1 shall be identified on a permanent nameplate installed on the product by the manufacturer. Alternatively, when doors do not have such nameplate, the installer or supplier of any such doors shall provide a signed and dated certification for the installed doors listing the U-factor and the air leakage rate.

**4.4.4 Building Envelope Insulation.** The rated R-value shall be clearly identified by an identification mark applied by the manufacturer to each piece of building envelope insulation. Alternatively, when insulation does not have such an identification mark, the installer of such insulation shall provide a signed and dated certification for the installed insulation listing the type of insulation, the manufacturer, the rated R-value, and, where appropriate, the initial installed thickness, the settled thickness, and the coverage area.

**4.4.5 Mechanical Equipment.** Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE Standard 90.1-2001.

**4.4.6 Packaged Terminal Air Conditioners.** Packaged terminal air conditioner and heat pumps with sleeve sizes less than 16 in. high and 42 in. wide shall be factory labeled as follows: “Manufactured for replacement application only: not to be installed in new construction projects”.

**4.4.7 Transformers.** The energy-efficiency level shall be identified on a permanent nameplate installed on the transformer by the manufacturer.

**4.5 Alternative Materials, Methods of Construction, or Design.** The provisions of this standard are not intended to prevent the use of any material, method of construction, design equipment, or building system not specifically prescribed herein.

**4.6 Inspections.** All building construction, additions, or alterations subject to the provisions of this standard shall be subject to inspection by the Alabama Building Commission, and all such work shall remain accessible and exposed for inspection purposes until approved in accordance with procedures specified by the Alabama Building Commission. Items for inspection include at least the following:

- a. wall insulation after wall insulation and vapor retarder are in place but before concealment,
- b. roof/ceiling insulation after roof/ceiling insulation is in place but before concealment,
- c. slab/foundation wall after slab/foundation wall insulation is in place but before concealment,
- d. fenestration after all glazing materials are in place,
- e. mechanical systems, equipment, and insulation after installation but before concealment, and
- f. electrical equipment and systems after installation but before concealment.

**4.7 Referenced Standards.** The standards referenced in this standard and listed in Section 12 of ASHRAE 90.1-2001 shall be considered part of the requirements of this standard to the prescribed extent of such reference. Where differences occur between the provisions of this standard and referenced standards, the provisions of this standard shall apply. Informative references are cited to acknowledge sources and are not part of this standard. They are identified in Informative Appendix E of ASHRAE 90.1-2001.

**4.8 Normative Appendices.** The normative appendices to ASHRAE 90.1-2001 are considered to be integral parts of the mandatory requirements of this standard, which, for reasons of convenience, are placed apart from all other normative elements.

**4.9 Informative Appendices.** The informative appendices to ASHRAE 90.1-2001 and informative notes located within this standard contain additional information and are not mandatory or a part of this standard.

**4.10 Validity.** If any term, part, provision, section, paragraph, subdivision, table, chart, or referenced standard of this standard shall be held unconstitutional, invalid, or ineffective in whole or in part, such determination shall not be deemed to

invalidate any remaining terms, parts, provisions, sections, paragraphs, subdivisions, tables, or charts of this standard.

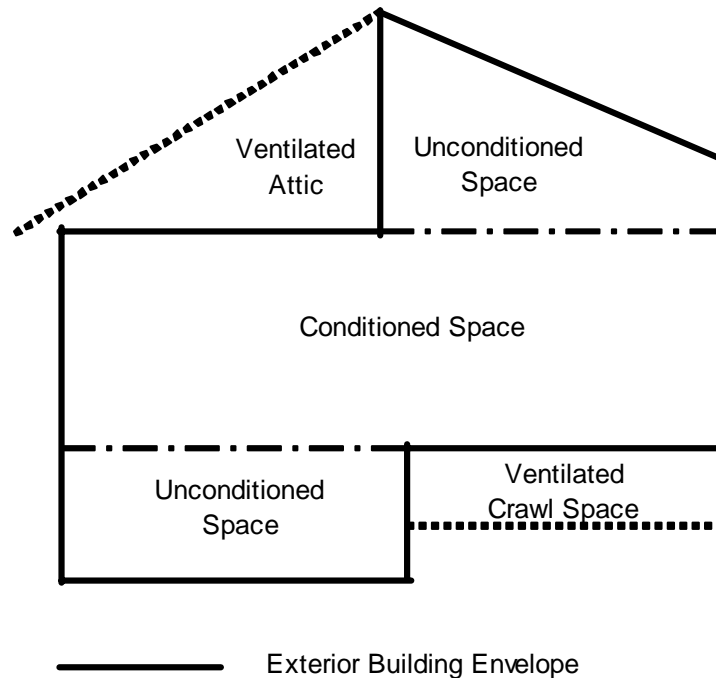
**4.11 Manuals.** Operating and maintenance information shall be provided to the building owner. This information shall include, but not be limited to, the information specified in 6.2.5.2 of ASHRAE 90.1-2001 and 8.2.2.2.

**4.12 Other Laws.** The provisions of this standard shall not be deemed to nullify any provisions of local, state, or federal law. Where there is a conflict between a requirement of this standard and such other law affecting construction of buildings, precedence shall be determined by the Alabama Building Commission.

## **5. BUILDING ENVELOPE**

### **5.1 General**

**5.1.1 Building Envelope Scope.** Section 5 specifies requirements for the exterior building envelope, which separates conditioned and unconditioned spaces from the exterior. Figure 5.1 provides a graphic definitions of building spaces. Section 5 does not address moisture control or provide design guidelines to prevent moisture migration that leads to condensation, mold and mildew, or deterioration to insulation or equipment performance.



**Figure 5.1 Building Envelope**

**5.1.2 Compliance.** For the appropriate climate zone, and class of construction, the building envelope shall comply with

- a. 5.1, General
- b. 5.2, Mandatory Provisions, and
- c. either

(1) 5.3, Prescriptive Building Envelope Option, provided that

(a) the vertical fenestration area does not exceed 50% of the gross wall area and

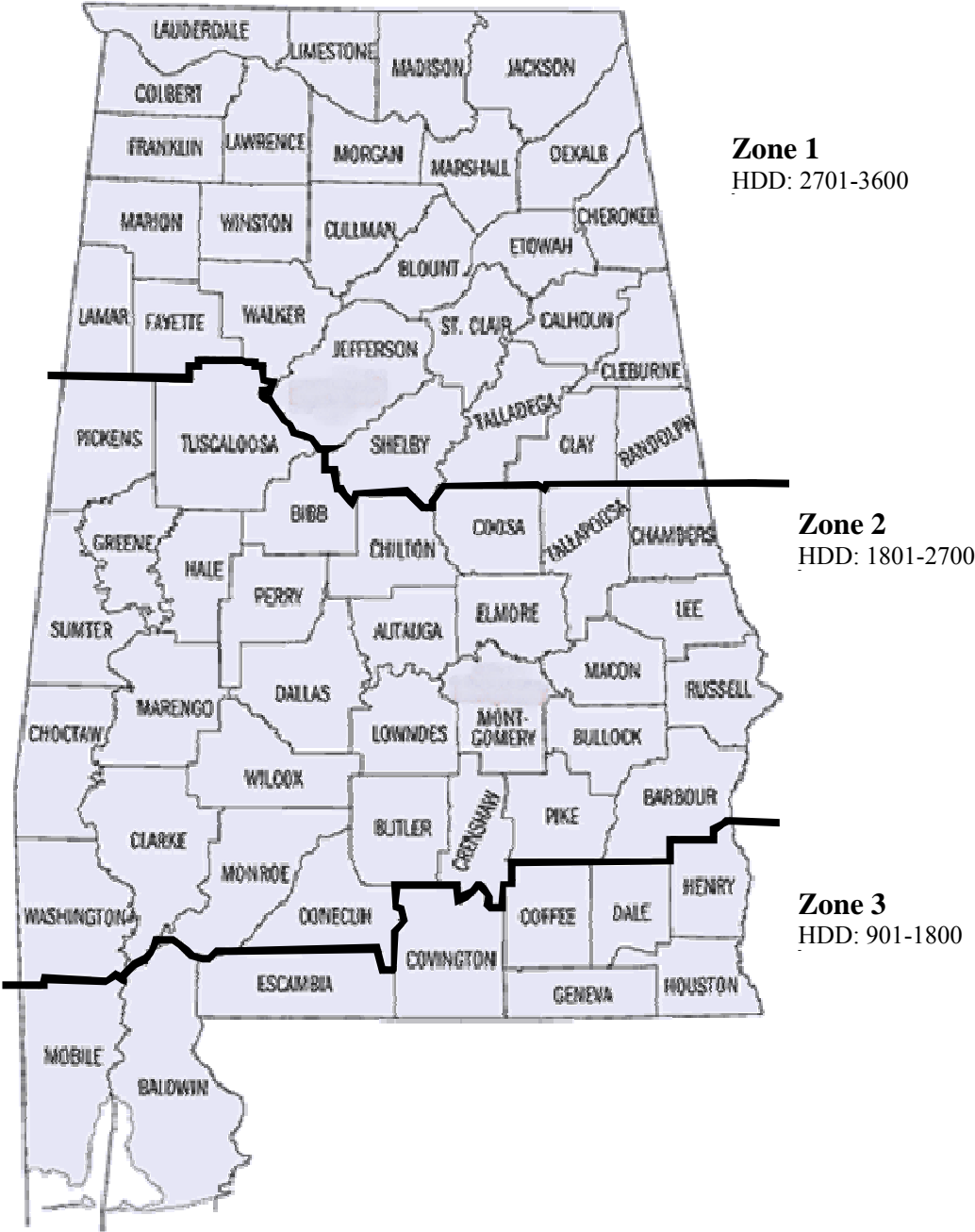
(b) the skylight fenestration area does not exceed 5% of the gross roof area, or

(2) 5.4, Building Envelope Trade-Off Option.

**5.1.3 Climate.** The Alabama Climate Zones are based on the cooling degree-days base 50E F, CDD50, and heating degree-days base 65E F, HDD65.

**5.1.3.1 Alabama Climate Zones - See Figure 5.2 for the proper climate zone.**

Figure 5.2 Alabama Climate Zones



## **5.2 Mandatory Provision**

**5.2.1 Insulation General.** Where insulation is required in 5.3 or 5.4, it shall also comply with 5.5.1.1 through 5.5.1.5.

**5.2.2** Fenestration and doors shall comply with 5.5.2

**5.2.3 Air Leakage.**

**5.2.3.1 Building Envelope Sealing.** Building envelope sealing shall comply with 5.5.3.1, air leakage for fenestration and doors shall comply with 5.5.3.2, loading dock weather seals shall comply with 5.5.3.3, and vestibules shall comply with 5.5.3.4.

## **5.3 Prescriptive Building Envelope Option**

For conditioned spaces and unconditioned spaces, the exterior building envelope shall comply with the requirements in Table 5.3.1, Table 5.3.2 or Table 5.3.3 for the appropriate climate zone. There are two parts to each table; the first part of each table lists the required thermal properties for opaque areas. The second part of the table establishes the minimum standards of fenestration.

TABLE 5.3.1 Building Envelope Requirements - Zone 1		
Opaque Elements	Conditioned or Unconditioned Space	
	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>		
Insulation Entirely above Deck	U-0.063	15.0 c.i.
Metal Building	U-0.065	19.0
Attic and Other	U-0.034	30.0
<i>Walls, Above Grade</i>		
Mass	U-0.151	5.7 c.i.
Metal Building	U-0.113	13.0
Steel Framed	U-0.124	13.0
Wood Framed and Other	U-0.089	13.0
<i>Wall, Below Grade</i>		
Below Grade Wall	C-1.14	NR
<i>Floors</i>		
Mass	U-0.107	6.3 c.i.
Steel Joist	U-0.052	19.0
Wood Framed and Other	U-0.051	19.0
<i>Slab-on-Grade Floors</i>		
Unheated	F-0.730	NR
Heated	F-1.020	7.5 for 12 in.
<i>Opaque Doors</i>		
Swinging	U-0.700	
Non-Swinging	U-1.450	
Source - Table B-11 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required		

TABLE 5.3.1 Building Envelope Requirements - Climatic Zone 1, continued			
Fenestration	Conditioned or Unconditioned Space		
	Assembly Maximum U-Factor	Assembly Maximum SHGC	
		All Orientations	North Oriented
<b>Fixed</b> Vertical Glazing % of Wall 0 - 10%	0.57	0.39	0.49
10.1 - 40%	0.57	0.39	0.49
40.1 - 50%	0.46	0.27	0.32
<b>Operable</b> Vertical Glazing % of Wall 0-10%	0.67	0.39	0.49
10.1 - 40%	0.67	0.39	0.49
40.1 - 50%	0.47	0.27	0.32
<b>Skylight</b> with Curb, Glass, % of Roof 0 - 2.0%	1.17	0.49	
2.1 - 5.0%	1.17	0.39	
<b>Skylight</b> with Curb, Plastic % of Roof 0 - 2.0%	1.30	0.65	
2.1 - 5.0%	1.30	0.34	
<b>Skylight</b> without Curb, all % of Roof 0 - 2.0%	0.69	0.49	
2.1 - 5.0%	0.69	0.39	
Source - Table B-11 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required			



TABLE 5.3.2 Building Envelope Requirements - Climatic Zone 2		
Opaque Elements	Conditioned or Unconditioned Space	
	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>		
Insulation Entirely above Deck	U-0.063	15.0 c.i.
Metal Building	U-0.065	19.0
Attic and Other	U-0.034	30.0
<i>Walls, Above Grade</i>		
Mass	U-0.580	NR
Metal Building	U-0.113	13.0
Steel Framed	U-0.124	13.0
Wood Framed and Other	U-0.089	13.0
<i>Wall, Below Grade</i>		
Below Grade Wall	C-1.140	NR
<i>Floors</i>		
Mass	U-0.137	4.2 c.i.
Steel Joist	U-0.052	19.0
Wood Framed and Other	U-0.051	19.0
<i>Slab-on-Grade Floors</i>		
Unheated	F-0.730	NR
Heated	F-1.020	7.5 for 12 in.
<i>Opaque Doors</i>		
Swinging	U-0.700	
Non-Swinging	U-1.450	
Source - Table B-8 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required		

TABLE 5.3.2 Building Envelope Requirements - Climatic Zone 2, continued			
Fenestration	Conditioned or Unconditioned Space		
	Assembly Maximum U-Factor	Assembly Maximum SHGC	
		All Orientations	North Oriented
<b>Fixed</b> Vertical Glazing % of Wall 0 - 10%	1.22	0.39	0.61
10.1 - 40%	1.22	0.25	0.61
40.1 - 50%	1.22	0.15	0.38
<b>Operable</b> Vertical Glazing % of Wall 0-10%	1.27	0.39	0.61
10.1 - 40%	1.27	0.25	0.61
40.1 - 50%	1.27	0.15	0.38
<b>Skylight</b> with Curb, Glass, % of Roof 0 - 2.0%	1.98	0.39	
2.1 - 5.0%	1.98	0.19	
<b>Skylight</b> with Curb, Plastic % of Roof 0 - 2.0%	1.90	0.65	
2.1 - 5.0%	1.90	0.34	
<b>Skylight</b> without Curb, all % of Roof 0 - 2.0%	1.36	0.39	
2.1 - 5.0%	1.36	0.19	
Source - Table B-8 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required			

TABLE 5.3.3 Building Envelope Requirements - Climatic Zone 3		
Opaque Elements	Conditioned or Unconditioned Space	
	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>		
Insulation Entirely above Deck	U-0.063	15.0 c.i.
Metal Building	U-0.065	19.0
Attic and Other	U-0.034	30.0
<i>Walls, Above Grade</i>		
Mass	U-0.580	NR
Metal Building	U-0.113	13.0
Steel Framed	U-0.124	13.0
Wood Framed and Other	U-0.089	13.0
<i>Wall, Below Grade</i>		
Below Grade Wall	C-1.140	NR
<i>Floors</i>		
Mass	U-0.137	4.2 c.i.
Steel Joist	U-0.052	19.0
Wood Framed and Other	U-0.051	19.0
<i>Slab-on-Grade Floors</i>		
Unheated	F-0.730	NR
Heated	F-1.020	7.5 for 12 in.
<i>Opaque Doors</i>		
Swinging	U-0.700	
Non-Swinging	U-1.450	
Source - Table B-6 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required		

TABLE 5.3.3 Building Envelope Requirements - Climatic Zone 3, continued

Fenestration	Conditioned or Unconditioned Space		
	Assembly Maximum U-Factor	Assembly Maximum SHGC	
		All Orientations	North Oriented
<b>Fixed</b> Vertical Glazing % of Wall 0 - 10%	1.22	0.39	0.61
10.1 - 40%	1.22	0.25	0.61
40.1 - 50%	1.22	0.17	0.42
<b>Operable</b> Vertical Glazing % of Wall 0-10%	1.27	0.39	0.61
10.1 - 40%	1.27	0.25	0.61
40.1 - 50%	1.27	0.17	0.42
<b>Skylight</b> with Curb, Glass, % of Roof 0 - 2.0%	1.98	0.39	
2.1 - 5.0%	1.98	0.25	
<b>Skylight</b> with Curb, Plastic % of Roof 0 - 2.0%	1.90	0.65	
2.1 - 5.0%	1.90	0.39	
<b>Skylight</b> without Curb, all % of Roof 0 - 2.0%	1.36	0.39	
2.1 - 5.0%	1.36	0.25	
Source - Table B-6 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required			

**5.3.1 Opaque Areas.** Opaque surfaces shall comply with the following sections:

- a. **Roof Insulation** shall comply with 5.3.1.1,
- b. **Above-Grade Wall Insulation** shall comply with 5.3.1.2,
- c. **Below-Grade Wall Insulation** shall comply with 5.3.1.3,
- d. **Floor Insulation** shall comply with 5.3.1.4,
- e. **Slab-On-Grade Floor Insulation** shall comply with 5.3.1.5,
- f. **Opaque doors** shall comply with 5.3.1.6

For all opaque surfaces except doors, compliance shall be demonstrated by one of the following three methods:

- (1) Compliance with the minimum rated R-values of insulation shall be demonstrated for the thermal resistance of the added insulation in framing cavities and continuous insulation only. Rated R-values of insulation shall not include the thermal transmittance of other building materials or air films. Insulation shall extend over the full component area to the intended rated R-value of insulation unless otherwise allowed in 5.2.1. If NR appears in a table, there are no insulation requirements for that class of construction and space-conditioning category. This option does not apply to opaque doors.
- (2) Compliance shall be shown with the maximum U-factor, C-factor, or F-factor for the entire assembly in Table 5.3.1, Table 5.3.2 or Table 5.3.3 for the component in lieu of complying with the minimum rated R-value of insulation for the insulation alone. U-factors, C-factors, and F-factors for typical construction assemblies are included in Normative Appendix A of ASHRAE 90.1-2001, and these values shall be used to determine compliance. For assemblies significantly different from those in Normative Appendix A, calculations shall be performed in accordance with the procedures required in Normative Appendix A of ASHRAE 90.1-2001. If NR appears in a table in the minimum insulation column, there are also no maximum U-factor, C-factor, or F-factor requirements for the entire assembly for that class of construction and space-conditioning category for the prescriptive option in 5.3. However, the U-factor, C-factor, or F-factor specified is the basis for the trade-off option in 5.4.
- (3) If there are multiple assemblies within a single class of construction for a single space-conditioning category, compliance shall be shown for an area-weighted average U-factor, C-factor, or F-factor. It is not acceptable to do an area-weighted average for the rated R-value of insulation or to do an area-weighted average across multiple classes of construction or multiple space-conditioning categories.

**5.3.1.1 Roof Insulation.** All roofs, including roofs with insulation entirely above deck, metal building roofs, and attics and other roofs, shall have a rated R-value of insulation not less than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3. Skylight curbs shall be insulated to the level of roofs with insulation entirely

above the deck or R-5, whichever is less.

- a. For roofs with insulation entirely above deck, the rated R-value of insulation is for continuous insulation. Interruptions presented by framing and pads for mechanical equipment with the combined total area no greater than **one percent** of the opaque assembly area shall be permitted.
- b. For metal building roofs, the rated R-value of insulation is for insulation draped over purlins and then compressed when the metal spanning members are attached, or for insulation hung between the purlins, provided there is a minimum 1 in. thermal break between the purlins and the metal spanning members. For continuous insulation (e.g., insulation boards), it is assumed that the insulation boards are installed below the purlins and are uninterrupted by framing members. Insulation exposed to the conditioned space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.
- c. For attics and other roofs, the rated R-value of insulation is for insulation installed both inside and outside the roof, or entirely inside the roof cavity, and it allows occasional interruption by framing members but requires that the framing members be covered with insulation when the depth of the insulation exceeds the depth of the framing cavity. Insulation in attics and other roofs shall be permitted to be tapered at the eaves where the building structure does not allow full depth. For single-rafter roofs (cathedral ceilings), the requirement is the lesser of the values for attics and other roofs and those listed in Table 5.3.1.1A.

**TABLE 5.3.1.1A**  
**Single Rafter Roofs**

Minimum Insulation R-Value or Maximum Assembly U-Factor		
Wood Rafter Depth, d (actual)		
d ≤ 8 in.	8 in. < d ≤ 10 in.	10 in. < d ≤ 12 in.
R-19 or U-0.055	R-30 or U-0.036	R-38 or U-0.028

**Exception to 5.3.1.1:** For roofs where the exterior surface has a minimum total solar reflectance of 0.70 when tested in accordance with ASTM E903, ASTM E1175 or ASTM E1918, and has a minimum thermal emittance of 0.75 when tested in accordance with ASTM C835, ASTM C1371 or ASTM E408, other than roofs with ventilated attics, the U-factor of the proposed roof shall be permitted to be

adjusted using Equation 5-1 for demonstrating compliance.

$$U_{\text{roofadj}} = 0.85 \times U_{\text{roofproposed}} \quad (5-1)$$

where:

$U_{\text{roofadj}}$  = the adjusted roof U-factor for use in demonstrating compliance.

$U_{\text{roofproposed}}$  = the U-Factor of the proposed roof, as designed.

**5.3.1.2 Above-Grade Wall Insulation.** All above-grade walls, including mass walls, metal building walls, steel-framed walls, and wood-framed and other walls, shall have a rated R-value of insulation not less than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3. Mass wall heat capacity shall be determined from Table A-6 or A-7 of ASHRAE 90.1-2001, as appropriate.

**a.** For mass walls, the rated R-value of insulation is for continuous insulation uninterrupted by framing other than 20 gauge 1 in. metal clips spaced no closer than 24 in. on center horizontally and 16 in. on center vertically. Where other framing, including metal and wood studs, is used, compliance shall be based on the maximum assembly U-factor. Where rated R-value of insulation is used for concrete sandwich panels, the insulation shall be continuous throughout the entire panel.

**b.** For metal building walls, the rated R-Value of insulation is for insulation compressed between metal wall panels and the steel structure. For continuous insulation (e.g., insulation boards) it is assumed that the insulation boards are installed on the inside of the girts and uninterrupted by the framing members. Insulation exposed to the conditioned space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

**c.** For steel-framed walls, the rated R-value of insulation is for uncompressed insulation installed in the cavity between steel studs. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing. Opaque mullions in spandrel glass shall be covered with insulation complying with the steel-framed wall requirements.

**d.** For wood-framed and other walls, the rated R-value of insulation is for uncompressed insulation installed in the cavity between wood studs. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing. When a wall consists of both above-grade and below-grade portions, the entire wall for that story shall be insulated on either the exterior or the interior or be integral. If insulated on the interior, the wall shall be insulated to the above-grade wall requirements. If insulated on the exterior or integral, the below-grade wall portion shall be insulated to the below-grade wall requirements, and the

above-grade wall portion shall be insulated to the above-grade wall requirements.

**5.3.1.3 Below-Grade Wall Insulation.** Below-grade walls shall have a rated R-value of insulation not less than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3. For below-grade walls, the rated R-value of insulation is for continuous insulation uninterrupted by framing. Where framing, including metal and wood studs, is used, compliance shall be based on the maximum assembly C-factor.

**5.3.1.4 Floor Insulation.** All floors, including mass floors, steel joist floors, and wood-framed and other floors, shall have a rated R-value of insulation not less than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3.

- a. For mass floors, the rated R-value of insulation is for continuous insulation uninterrupted by framing. Where framing, including metal and wood joists, is used, compliance shall be based on the maximum assembly U-factor rather than the minimum rated R-value of insulation. For waffle-slab floors, the floor shall be insulated either on the interior above the slab or on all exposed surfaces of the waffle. For floors with beams that extend below the floor slab, the floor shall be insulated either on the interior above the slab or on the exposed floor and all exposed surfaces of the beams that extend 24 in. and less below the exposed floor.
- b. For steel joist floors, the rated R-value of insulation is for uncompressed insulation installed in the cavity between steel joists or for spray-on insulation. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing. All continuous insulation shall be installed either on the interior above the floor structure or below a framing cavity completely filled with insulation.
- c. For wood-framed and other floors, the rated R-value of insulation is for uncompressed insulation installed in the cavity between wood joists. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing. All continuous insulation shall be installed either on the interior above the floor structure or below a framing cavity completely filled with insulation.

**5.3.1.5 Slab-on-Grade Floor Insulation.** No insulation is required for unheated slab-on-grade floors. Heated slab-on-grade floors shall have a rated R-value of insulation not less than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3 and shall be installed around the perimeter of the slab-on-grade floor to the distance specified. Perimeter insulation installed inside the foundation wall shall extend downward from the top of the slab a minimum of the distance specified or



to the top of the footing, whichever is less. Perimeter insulation installed outside the foundation wall shall extend from the top of the slab, or downward to at least the bottom of the slab and then horizontally to a minimum of the distance specified. In all climates, the horizontal insulation extending outside of the foundation shall be covered by pavement or by soil a minimum of 10 in. thick.

**Exception to 5.3.1.5:** For a monolithic slab-on-grade floor, the insulation shall extend from the top of the slab-on-grade to the bottom of the footing.

**5.3.1.6 Opaque Doors.** All opaque doors, including swinging doors and non-swinging doors, shall have a U-factor not greater than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3.

**5.3.2 Fenestration.** Compliance with U-factors and solar-heat gain coefficient (SHGC) shall be demonstrated for the overall fenestration product, including glass, sash, and frame, as provided in 5.2.2.

**Exception to 5.3.2:** Alternatively, if there are multiple assemblies within a single class of construction, compliance shall be based on an area-weighted average U-factor or SHGC. It is not acceptable to do an area-weighted average across multiple classes of construction.

**5.3.2.1 Fenestration Area.** The total vertical fenestration area, including both fixed vertical fenestration and operable vertical fenestration, shall be less than 50% of the gross wall area. The total skylight area, including glass skylights, plastic skylights with a curb, and all skylights without a curb, shall be less than 5% of the gross roof area.

**Exception to 5.3.2.1:** Vertical fenestration complying with Exception (c) to 5.3.2.3.

**5.3.2.2 Fenestration U-Factor.** Fenestration, including fixed vertical fenestration, operable vertical fenestration, glass skylights with a curb, plastic skylights with a curb, and all skylights without a curb shall have a U-factor not greater than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3 for the appropriate fenestration area. U-factor for fenestration shall be determined in accordance with 5.2.2.

**Exception to 5.3.2.2:** Vertical fenestration complying with Exception (c) to 5.3.2.3 shall have a U-factor not greater than that specified for the 10% to 40% range of the gross wall area.

**5.3.2.3 Fenestration Solar Heat Gain Coefficient (SHGC).** Vertical fenestration shall have a SHGC not greater than that specified for “all” orientations in Table 5.3.1, Table 5.3.2 or Table 5.3.3 for the appropriate total vertical fenestration area. Skylights, including glass skylights with a curb, plastic skylights with a curb, and

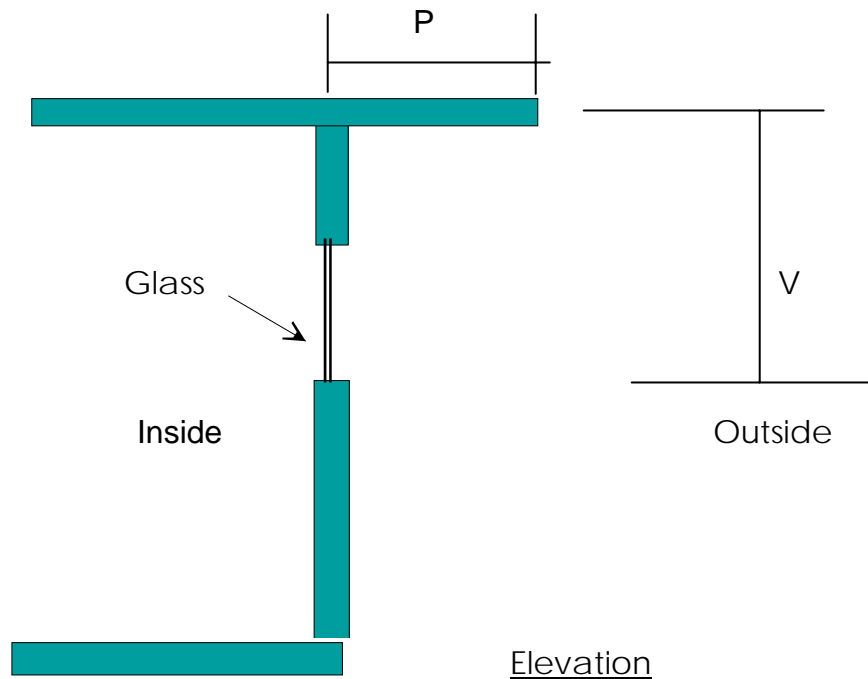
all skylights without a curb, shall have an SHGC not greater than that specified for “all” orientations in Table 5.3.1, Table 5.3.2 or Table 5.3.3 for the appropriate total skylight area. SHGC for fenestration shall be determined in accordance with 5.2.2.

**Exceptions to 5.3.2.3:**

- (a) Alternatively, the SHGC for north-oriented vertical fenestration shall be calculated separately and shall not be greater than that specified in Table 5.3.1, Table 5.3.2 or Table 5.3.3 for north-oriented fenestration. When this exception is used, the fenestration area used in selecting the criteria shall be calculated separately for north-oriented and all other-oriented fenestration.
- (b) For demonstrating compliance for vertical fenestration only, the SHGC in the proposed building shall be reduced by using the multipliers in Table 5.3.2.3 for each fenestration product shaded by permanent projections that will last as long as the building itself.

**TABLE 5.3.2.3**  
**SHGC Multipliers for Permanent Projections**

Projection Factor (PF = P/V)	SHGC Multiplier (All Other Orientations)	SHGC Multiplier (North Orientation)
0 - 0.10	1.00	1.00
<0.10 - 0.20	0.91	0.95
<0.20 - 0.30	0.82	0.91
<0.30 - 0.40	0.74	0.87
<0.40 - 0.50	0.67	0.84
<0.50 - 0.60	0.61	0.81
<0.60 - 0.70	0.56	0.78
<0.70 - 0.80	0.51	0.76
<0.80 - 0.90	0.47	0.75
<0.90 - 1.00	0.44	0.73



- (c) Vertical fenestration that is located on the street side of the street-level story only, provided that
1. the street side of the street-level story does not exceed 20ft. in height,
  2. the fenestration has a continuous overhanging with weighted average projection factor greater than 0.5, and
  3. the fenestration area for the street side of the street-level story is less than 75% of the gross wall area for the street side of the street-level story.

When this exception is utilized, separate calculation shall be performed for these sections of the building envelope, and these values shall not be averaged with any others for compliance purposes. No credit shall be given here or elsewhere in the building for not fully utilizing the fenestration area allowed. This exception does not apply to the building envelope trade-off option in 5.4 or the energy cost budget option in 11.

**5.3.2.4 Visible Light Transmittance (VLT).** There are no minimum visible light transmittance criteria in the prescriptive Building Envelope Option; however, there are minimum criteria in the Building Envelope Trade-Off Option.

#### **5.4 Building Envelope Trade-Off Option**

The building envelope complies with the standard if the proposed building satisfies the provision of 5.1 and 5.2 and the envelope performance factor of the proposed building is less than or equal to the envelope performance factor of the budget building. The envelope performance factor considers only the building envelope components. Schedules of operation, lighting power, equipment power, occupant density, and mechanical systems shall be the same for both the proposed building and the budget building. Envelope performance factor shall be calculated using the procedures of Normative Appendix C of ASHRAE 90.1-2001.

#### **5.5 Mandatory Provisions**

##### **5.5.1 Insulation General**

**5.5.1.1 Insulation Installation.** Insulation materials shall be installed in accordance with manufacturer's recommendations and in such a manner as to achieve rated R-value of insulation. Open-blown or poured loose-fill insulation shall not be used in attic roof spaces when the slope of the ceiling is more than three in twelve (3 in 12). When eave vents are installed, baffling of the vent openings shall be provided to deflect the incoming air above the surface of the insulation.

**Exception to 5.5.1.1:** Where metal building roof and metal building wall insulation is compressed between the roof or wall skin and the structure.

**5.5.1.2 Substantial Contact.** Insulation shall be installed in a permanent manner in substantial contact with the inside surface in accordance with manufacturer's

recommendations for the framing system used. Flexible batt insulation installed in floor cavities shall be supported in a permanent manner by supporters no greater than 24 in. on center.

**Exception to 5.5.1.2:** Insulation materials that rely on air-spaces adjacent to reflective surfaces for their rated performance.

**5.5.1.3 Recessed Equipment.** Lighting fixtures; heating, ventilating, and air-conditioning equipment, including wall heaters, ducts, and plenums; and other equipment shall not be recessed in such a manner as to affect the insulation thickness unless:

- a. the total combined area affected (including necessary clearances) is less than one percent of the opaque area of the assembly, or
- b. the entire roof, wall, or floor is covered with insulation to the full depth required, or
- c. the effects of reduced insulation are included in calculations using an area-weighted average method and compressed insulation values obtained from Table A-24 of ASHRAE 90.1-2001.

In all cases, air leakage through or around the recessed equipment to the conditioned space shall be limited in accordance with 5.2.3.1.

**5.5.1.4 Location of Roof Insulation.** The roof insulation shall not be installed on a suspended ceiling with removable ceiling panels.

**5.5.1.5 Insulation Protection.** Exterior insulation shall be covered with a protective material to prevent damage from sunlight, moisture, landscaping operations, equipment maintenance, and wind. In attics and mechanical rooms, a way to access equipment that prevents damaging or compressing the insulation shall be provided. Foundation vents shall not interfere with the insulation. Insulation materials in ground contact shall have a water absorption rate no greater than 0.3% when tested in accordance with ASTM C272.

**5.5.2 Fenestration and Doors.** Product samples used for determining fenestration performance shall be production line units or representative of units as purchased by the consumer or contractor.

**5.5.2.1 U-Factor.** U-factors shall be determined in accordance with NFRC 100. U-factors for skylights shall be determined for a slope of 20 degree above the horizontal. U-factor shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be labeled and certified by the

manufacturer.

**Exceptions to 5.5.2.1:**

- (a) Unlabeled skylights - Refer to paragraph A8.1 of ASHRAE 90.1-2001 for determining compliance with the U-factor criteria for unlabeled skylights. Where credit is being taken for a low-emissivity coating, the emissivity of the coating shall be determined in accordance with NFRC 301. Emissivity shall be verified and certified by the manufacturer.
- (b) Unlabeled vertical fenestration - Refer to paragraph A8.2 of ASHRAE 90.1-2001 for determining compliance with the U-factor criteria for unlabeled vertical fenestration.
- (c) U-factors from paragraph A7 of ASHRAE 90.1-2001 shall be an acceptable alternate for determining compliance with the U-factor criteria for opaque doors.
- (d) For garage doors, NAGDM 105 shall be an acceptable alternate for determining U-factors.

**5.5.2.2 Solar Heat Gain Coefficient.** SHGC for the overall fenestration area shall be determined in accordance with NFRC 200. SHGC shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be labeled and certified by the manufacturer.

**Exceptions to 5.5.2.2:**

- (a) SHGC based on the shading coefficient of the center of glass multiplied by 0.86 shall be acceptable alternate for determining compliance with the SHGC requirements for the overall fenestration area. Shading coefficient shall be determined using a spectral data file determined in accordance with NFRC 300. Shading coefficient shall be verified and certified by the manufacturer.
- (b) SHGC of the center of glass shall be an acceptable alternate for determining compliance with the SHGC requirements for the overall fenestration area. SHGC shall be determined using a spectral data file determined in accordance with NFRC 300. SHGC shall be verified and certified by the manufacturer.
- (c) SHGC from paragraph A8.1 of ASHRAE 90.1-2001 shall be an acceptable alternate for determining compliance with the SHGC criteria for skylights. Where credit is being taken for a low-emissivity coating, the emissivity of

the coating shall be determined in accordance with NFRC 301. Emissivity shall be verified and certified by the manufacturer.

- (d) SHGC from paragraph A8.2 of ASHRAE 90.1-2001 shall be an acceptable alternate for determining compliance with the SHGC criteria for vertical fenestration.

**5.5.2.3 Visible Light Transmittance.** When 5.4, the Building Envelope Trade-Off Option is used, visible light transmittance shall be determined in accordance with NFRC 200. Visible light transmittance shall be verified and certified by the manufacturer.

### **5.5.3 Air Leakage**

**5.5.3.1 Building Envelope Sealing.** The following areas of the building envelope shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:

- a. joints around fenestration and door frames
- b. junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels
- c. openings at penetrations of utility services through roofs, walls, and floors
- d. site-built fenestration and doors
- e. building assemblies used as ducts or plenums
- f. joints, seams, and penetrations of vapor retarders
- g. all other openings in the building envelope. Outside air intakes, exhaust outlets, relief outlets, stair shaft, elevator shaft smoke relief openings, and other similar elements shall also comply with Sections 6.2.3.2.4 and 6.2.3.3 of ASHRAE 90.1-2001.

**5.5.3.2 Fenestration and Doors.** Air leakage for fenestration and doors shall be determined in accordance with NFRC 400. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be labeled and certified by the manufacturer. Air leakage shall not exceed 1.0 cfm/ft<sup>2</sup> for glazed swinging entrance doors and for revolving doors and 0.4 cfm/ft<sup>2</sup> for all other products.

#### **Exceptions to 5.5.3.2:**

- (a) Field-fabricated fenestration and doors.
- (b) For garage doors, air leakage determined by test at standard test conditions in accordance with NAGDM 105 shall be an acceptable alternate for compliance with air leakage requirements.

**5.5.3.3 Loading Dock Weatherseals.** Not required in Alabama.

**5.5.3.4 Vestibules.** A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than 7 ft when in the closed position.

**Exceptions to 5.5.3.4:**

- (a) Doors in buildings in Climate Zone 3.
- (b) Doors in buildings less than four stories above grade
- (c) Doors not intended to be used as a building entrance door, such as mechanical or electrical equipment rooms
- (d) Doors opening directly from a dwelling unit
- (e) Doors that open directly from a space less than 3000ft<sup>2</sup> in area
- (f) Doors in building entrances with revolving doors
- (g) Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

## **6. HEATING, VENTILATING, AND AIR CONDITIONING**

### **6.1 General - Refer to Section 6 of ASHRAE 90.1-2001**

## **7. SERVICE WATER HEATING**

### **7.1 General**

**7.1.1 Service Water Heating Scope.** Service water heating systems and equipment shall meet the requirements of this section.

**7.1.2 Compliance.** Compliance shall be achieved by meeting the requirements of either

- a. 7.2 (Mandatory Provisions) and 7.3 (Prescriptive Path), if applicable, or
- b. 7.2 (Mandatory Provisions) in conjunction with Section 11 (Energy Cost Budget Method).

### **7.2 Mandatory Provisions**

**7.2.1 Load Calculations.** Service water heating system design loads for the purpose of sizing systems and equipment shall be determined in accordance with manufacturers' published sizing guidelines or generally accepted engineering



standards and handbooks acceptable to the Alabama Building Commission (e.g., ASHRAE Handbooks-HVAC Applications).

**7.2.2 Equipment Efficiency.** All water heating equipment, hot water supply boilers used solely for heating potable water, pool heaters, and hot water storage tanks shall meet the criteria listed in Table 7.2.2 of ASHRAE 90.1-2001. Where multiple criteria are listed, all criteria shall be met. Omission of minimum performance requirements for certain classes of equipment does not preclude use of such equipment where appropriate. Equipment not listed in Table 7.2.2 of ASHRAE 90.1-2001 has no minimum performance requirements.

**Exception to 7.2.2:** All water heaters and hot water supply boilers having more than 140 gal of storage capacity are not required to meet the standby loss (SL) requirements of Table 7.2.2 of ASHRAE 90.1-2001 when

- (a) the tank surface is thermally insulated to R-12.5, and
- (b) a standing pilot light is not installed, and
- (c) gas-or oil-fired storage water heaters have a flue damper or fan-assisted combustion.

**7.2.3 Service Hot Water Piping Insulation.** The following piping shall be insulated to levels shown in Section 6, Table 6.2.4.1.3 of ASHRAE 90.1-2001:

- a. Recirculating system piping, including the supply and return piping of a circulating tank type water heater.
- b. The first 8 ft. of outlet piping for a constant temperature non-recirculating storage system.
- c. The inlet pipe between the storage tank and a heat trap in a non-recirculating storage system.
- d. Pipes that are externally heated (such as heat trace or impedance heating).

#### **7.2.4 Service Water Heating System Controls**

**7.2.4.1 Temperature Controls.** Temperature controls shall be provided that allow for storage temperature adjustment from 120 degrees F or lower to a maximum temperature compatible with the intended use.

**Exception to 7.2.4.1:** When the manufacturer's installation instructions specify a higher minimum thermostat setting to minimize condensation and resulting corrosion.

**7.2.4.2 Temperature Maintenance Controls.** Systems designed to maintain usage temperatures in hot water pipes, such as recirculating hot water systems or heat trace, shall be equipped with automatic time switches or other controls that can be set to switch off the usage temperature maintenance system during extended periods when hot water is not required.

**7.2.4.3 Outlet Temperature Controls.** Temperature controlling means shall be provided to limit the maximum temperature of water delivered from lavatory faucets in public facility restrooms to 110 degrees F.

**7.2.4.4 Circulating Pump Controls.** When used to maintain storage tank water temperature in supply lines, recirculating pumps shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of five minutes after the end of the heating cycle.

## **7.2.5 Pools**

**7.2.5.1 Pool Heaters.** Pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

**7.2.5.2 Pool Covers.** Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90 degree F shall have a pool cover with a minimum insulation value of R-12.

**Exception to 7.2.5.2:** Pools deriving over 60% of the energy for heating from site-recovered energy or solar energy source.

**7.2.5.3 Time Switches.** Time switches shall be installed on swimming pool heaters and pumps.

### **Exceptions to 7.2.5.3:**

- (a) Where public health standards require 24-hour pump operations.
- (b) Where pumps are required to operate solar and waste heat recovery pool heating systems.

**7.2.6 Heat Traps.** Vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a non-recirculating system shall have heat traps on both the inlet and outlet piping as close as practical to the storage tank. A heat trap is a means to counteract the natural convection of heated water in a vertical pipe run. The means is either a device specifically designed for the purpose or an arrangement of tubing that forms a loop of 360 degrees or piping that form the point of connection to the water heater (inlet or outlet) includes a length of piping directed downward before connection to the vertical piping of the supply water or hot water distribution system, as applicable.

## **7.3 Prescriptive Path**

**7.3.1 Space Heating and Water Heating.** The use of a gas-fired or oil-fired space heating boiler system otherwise complying with Section 6 to provide the total

space heating and water heating for a building is allowed when one of the following conditions is met.

- a. The single space heating boiler, or the component of a modular or multiple boiler system that is heating the service water, has a standby loss in Btu/h not exceeding:

$$(13.3 \times \text{pmd} + 400) / n,$$

where pmd is the probable maximum demand in gal/h determined in accordance with the procedures described in generally accepted engineering standards and handbooks, and n is the fraction of the year when the outdoor daily mean temperature is greater than 64.9 degree F.

The standby loss is to be determined for a test period of 24 hours duration while maintaining a boiler water temperature of at least 90 degree F above ambient, with an ambient temperature between 60 degree F and 90 degree F. For a boiler with a modulating burner, this test shall be conducted at the lowest input.

- b. It is demonstrated to the satisfaction of the Alabama Building Commission that the use of a single heat source will consume less energy than separate units.
- c. The energy input of the combined boiler and water heater system is less than 150,000 Btu/h.

**7.3.2 Service Water Heating Equipment.** Service water heating equipment used to provide the additional function of space heating as part of a combination (integrated) system shall satisfy all stated requirements for the service water heating equipment.

## **8. POWER**

**8.1 General** (Subsection 8.2 applies to all building power distribution systems).

### **8.2 Mandatory Provisions**

#### **8.2.1 Voltage Drop**

**8.2.1.1 Feeders.** Feeder conductors shall be sized for a maximum voltage drop of 2% at design load.

**8.2.1.2 Branch Circuits.** Branch circuit conductors shall be sized for a maximum voltage drop of 3% at design load.

## **8.2.2 Completion Requirements**

**8.2.2.1 Drawings.** Construction documents shall require that within 30 days after the date of system acceptance, record drawings of the actual installation shall be provided to the building owner, including:

- a. single-line diagram of the building electrical distribution system and
- b. floor plans including location and area served for all distribution.

**8.2.2.2 Manuals.** Construction documents shall require that an operating manual and maintenance manual be provided to the building owner. The manuals shall include, at a minimum, the following:

- a. Submittal data stating equipment rating and selected options for each piece of equipment requiring maintenance.
- b. Operation manuals and maintenance manuals for each piece of equipment requiring maintenance. Required routine maintenance actions shall be clearly identified.
- c. Names and addresses of at least one qualified service agency.
- d. A complete narrative of how each system is intended to operate.

## **9. LIGHTING**

**9.1 General** Lighting systems and equipment shall comply with the requirements of 9.2 and 9.3. This section shall apply to the following:

- a. interior spaces of buildings;
- b. exterior building features, including facades, illuminated roofs, architectural features, entrances, exits, loading docks, and illuminated canopies; and
- c. exterior building grounds lighting provided through the building's electrical service.

### **Exceptions to 9.1:**

- (a) emergency lighting that is automatically off during normal building operation,
- (b) lighting within living units,
- (c) lighting that is specifically designed as required by a health or life safety statute, ordinance or regulation,
- (d) decorative gas lighting systems.

## **9.2 Mandatory Provisions**

## **9.2.1 Lighting Control**

**9.2.1.1 Automatic Lighting Shutoff.** Interior lighting in buildings larger than 5000 ft<sup>2</sup> shall be controlled with an automatic control device to shut off building lighting in all spaces. This automatic control device shall function on either:

- a. a scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times-an independent program schedule shall be provided for areas of no more than 25,000 ft<sup>2</sup> but not more than one floor-or
- b. an occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space-or
- c. a signal from another control or alarm system that indicates the area is unoccupied.

**Exception to 9.2.1.1:** Lighting intended for 24-hour operation shall not require an automatic control device.

**9.2.1.2 Space Control.** Each space enclosed by ceiling-height partitions shall have at least one control device to independently control the general lighting within the space. Each control device shall be activated either manually by an occupant or automatically by sensing an occupant. Each control device shall:

- a. control a maximum of 2500 ft<sup>2</sup> area for a space 10,000 ft<sup>2</sup> or less and a maximum of 10,000 ft<sup>2</sup> area for a space greater than 10,000 ft<sup>2</sup>
- b. be capable of overriding the shutoff control required in 9.2.1.1 for no more than four hours, and
- c. be readily accessible and located so the occupant can see the controlled lighting.

**Exception to 9.2.1.2:** Remote location shall be permitted for reasons of safety or security when the remote control device has an indicator pilot light as part of or next to the control device and it shall be clearly labeled to identify the controlled lighting.

**9.2.1.3 Exterior Lighting Control.** Lighting for all exterior applications not exempted in 9.1 and 9.3.2 shall be controlled by a photo sensor or astronomical time switch that is capable of automatically turning off the exterior lighting when sufficient daylight is available or the lighting is not required.

**Exception to 9.2.1.3:** Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

#### 9.2.1.4 Additional Control

- a. **Display/Accent Lighting**-display or accent lighting shall have a separate control device.
- b. **Case Lighting**-lighting in cases used for display purposes shall have a separate control device.
- c. **Hotel and Motel Guest Room Lighting**-hotel and motel guest rooms and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaries and switched receptacles.
- d. **Task Lighting**-supplemental task lighting, including permanently installed undershelf or undercabinet lighting, shall have a control device integral to the luminaries or be controlled by a wall-mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting.
- e. **Nonvisual Lighting**-lighting for nonvisual applications, such as plant growth and food warming, shall have a separate control device.
- f. **Demonstration Lighting**-lighting equipment that is for sale or for demonstrations in lighting education shall have a separate control device.

**9.2.2 Tandem Wiring.** Luminaries designed for use with one or three linear fluorescent lamps greater than 30 W each shall use two-lamp tandem-wired ballasts in place of single-lamp ballasts when two or more luminaries are in the same space and on the same control device.

**Exceptions to 9.2.2:**

- (a) Recessed luminaries more than 10 ft apart measured center to center.
- (b) Surface-mounted or pendant luminaries that are not continuous.
- (c) Luminaries using single-lamp high-frequency electronic ballasts.
- (d) Luminaries using three-lamp high-frequency electronic or three-lamp electromagnetic ballasts.
- (e) Luminaries on emergency circuits.
- (f) Luminaries with no available pair.

**9.2.3 Exit Signs.** Exit sign luminaries operating at greater than 20 watts shall have a minimum source efficacy of 35 lumens/W.

**9.2.4 Installed Interior Lighting Power.** The installed interior lighting power shall include all power used by the luminaries, including lamps, ballasts, current regulators, and control devices except as specifically exempted in 9.3.1.

**Exception to 9.2.4:** If two or more independently operating lighting systems in a space are capable of being controlled to prevent simultaneous user operation, the installed interior lighting power shall be based solely on the lighting system with the highest wattage.

**9.2.5 Luminaire Wattage.** Luminaire wattage incorporated into the installed interior lighting power shall be determined in accordance with the following criteria:

- a. The wattage of incandescent or tungsten-halogen luminaires with medium screw base sockets and not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.
- b. The wattage of luminaires with permanently installed or remote ballasts or transformers shall be the operating input wattage of the maximum lamp/auxiliary combination based on values from the auxiliary manufacturer's literature or recognized testing laboratories.
- c. The wattage of line-voltage lighting track and plug-in busway that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the luminaires included in the system with a minimum of 30 W/lin ft.
- d. The wattage of low-voltage lighting track, cable conductor, rail conductor, and other flexible lighting systems that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the transformer supplying the system.
- e. The wattage of all other miscellaneous lighting equipment shall be the specified wattage of the lighting equipment.

**9.2.6 Exterior Building Grounds Lighting.** All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lumens/W unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under 9.1 or 9.3.2.

### **9.3 Prescriptive Path**

**9.3.1 Interior Lighting Power.** The interior lighting power allowance for a building or a separately metered or permitted portion of a building shall be determined by either the building area method described in 9.3.1.1 or the space-by-space method described in 9.3.1.2. Trade-offs of interior lighting power allowance among portions of the building for which a different method of calculation has been used are not permitted. The installed interior lighting power identified in accordance with 9.2.4 shall not exceed the interior lighting power allowance developed in accordance with 9.3.1.1 or 9.3.1.2.

**Exceptions to 9.3.1:** The following lighting equipment and applications shall not be considered when determining the interior lighting power allowance developed in accordance with 9.3.1.1 or 9.3.1.2, nor shall the wattage for such lighting be included in the installed interior lighting power identified in accordance with

9.2.4. However, any such lighting shall not be exempt unless it is an addition to general lighting and is controlled by an independent control device.

- (a) Display or accent lighting that is an essential element for the function performed in galleries, museums, and monuments.
- (b) Lighting that is integral to equipment or instrumentation and is installed by its manufacturer.
- (c) Lighting specifically designed for use only during medical or dental procedures and lighting integral to medical equipment.
- (d) Lighting integral to both open and glass enclosed refrigerator and freezer cases.
- (e) Lighting integral to food warming and food preparation equipment.
- (f) Lighting for plant growth or maintenance.
- (g) Lighting in spaces specifically designed for use by the visually impaired.
- (h) Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
- (i) Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
- (j) Lighting that is an integral part of advertising or directional signage.
- (k) Exit signs.
- (l) Lighting that is for sale or lighting educational demonstration systems.
- (m) Lighting for theatrical purposes, including performance, stage, and film and video production.
- (n) Athletic playing areas with permanent facilities for television broadcasting.

**9.3.1.1 Building Area Method of Calculating Interior Lighting Power Allowance.**

Use the following steps to determine the interior lighting power allowance by the building area method:

- a. Determine the appropriate building area type from Table 9.3.1.1 and the allowed lighting power density (watts per square foot) from the building area method column. For building area types not listed, selection of a reasonably



equivalent type shall be permitted.

- b. Determine the gross lighted floor area (square feet) of the building area type.
- c. Multiply the gross lighted floor areas of the building area type(s) times the lighting power density.
- d. The interior lighting power allowance (watts) for the building is the sum of the lighting power allowances of all building area types. Trade-offs among building area types are permitted provided that the total installed interior lighting power does not exceed the interior lighting power allowance.

**Table 9.3.1.1 Lighting Power Densities Using  
the Building Area Method**

<b>Building Area Type<sup>a</sup></b>	<b>Lighting Power Density (W/ft<sup>2</sup>)</b>
Automotive Facility	1.5
Convention Center	1.4
Court House	1.4
Dining: Bar Lounge/Leisure	1.5
Dining: Cafeteria/Fast Food	1.8
Dining: Family	1.9
Dormitory	1.5
Exercise Center	1.4
Gymnasium	1.7
Hospital/Health Care	1.6
Hotel	1.7
Library	1.5
Motel	2.0
Motion Picture Theater	1.6
Multi-Family	1.0
Museum	1.6
Office	1.3
Parking Garage	0.3
Penitentiary	1.2
Performing Arts Theater	1.5
Police/Fire Station	1.3
Retail	1.9
School/University	1.5
Sports Arena	1.5
Transportation	1.2
Warehouse	1.2
Workshop	1.7
a - In cases where both general building area type and a specific building area type are listed, the specific building area type shall apply.	

**9.3.1.2 Space-by-Space Method of Calculating Interior Lighting Power Allowance.**  
**Refer to Paragraph 9.3.1.2 of ASHRAE 90.1-2001**

**9.3.2 Exterior Building Lighting Power.** The exterior building facade lighting power shall not exceed 0.25 W/ft<sup>2</sup> of the illuminated area. The exterior lighting power allowance for all other exterior building applications is the sum of the lighting power limits permitted and specified in Table 9.3.2 for these applications. Exterior lighting for all applications (except those included in the exceptions to 9.1 and 9.3.2) shall comply with the requirements of 9.2.6.

**TABLE 9.3.2 Lighting Power Limits for Building Exteriors**

Applications	Power Limits
Building entrance with canopy or free standing canopy	3 W/ft <sup>2</sup> of canopied area
Building entrance without canopy	33 W/lineal ft of door width
Building exit	20 W/lineal ft of door width

**Exception to 9.3.2:** Lighting used for the following exterior applications is exempt when equipped with an independent control device:

- (a) specialized signal, directional, and marker lighting associated with transportation;
- (b) lighting used to highlight features of public monuments and registered historic landmark structures or buildings; and
- (c) lighting that is integral to advertising signage.

**10. OTHER EQUIPMENT - Refer to ASHRAE 90.1-2001**

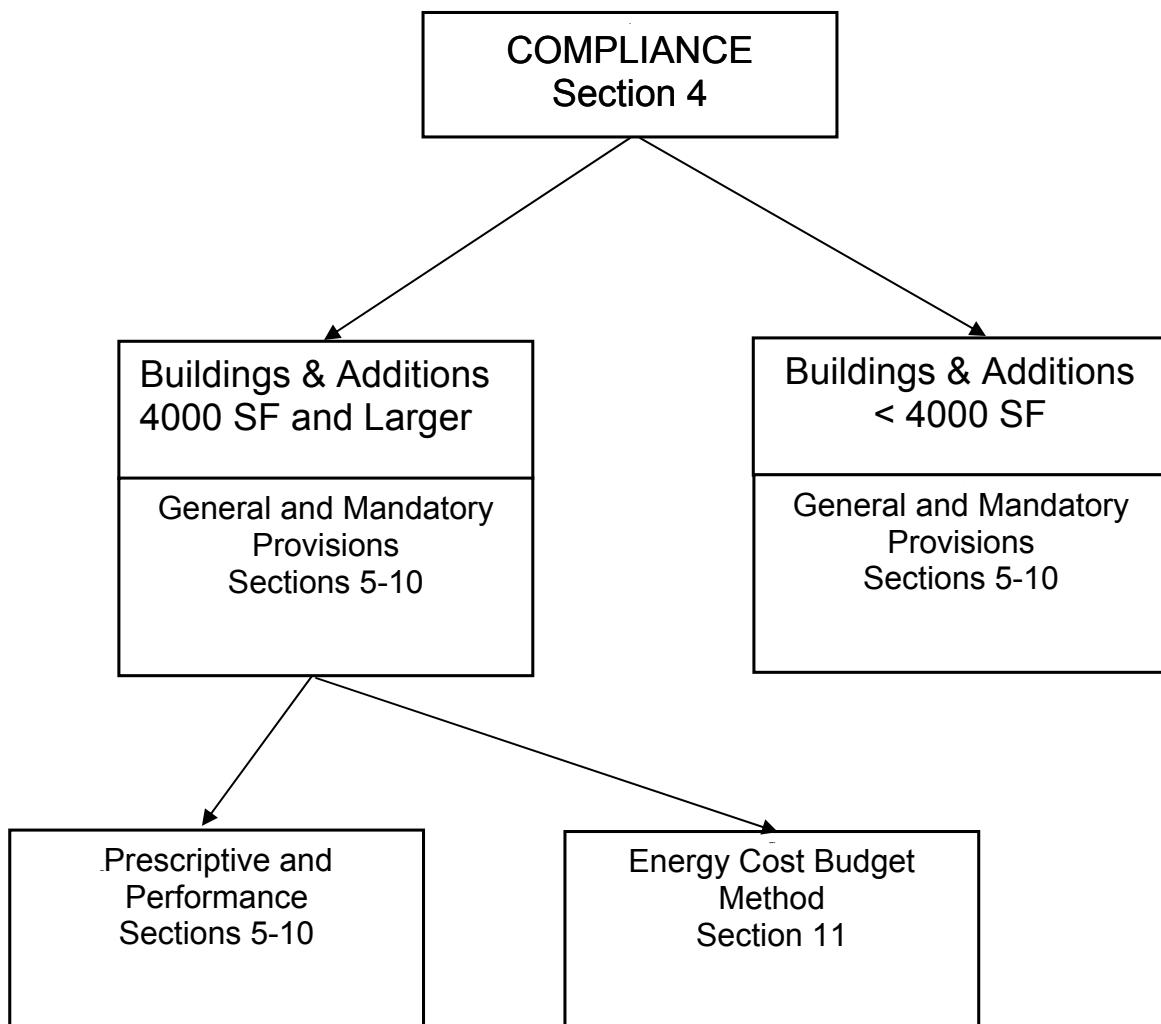
**11. ENERGY COST BUDGET METHOD - Refer to ASHRAE 90.1-2001**

# APPENDIX A

## Compliance Flow Chart and Checklists

Complete the forms applicable to the Project

### Flow Chart



## Alabama Building Energy Conservation Code -2004

Date:		Designer:
Project:		Phone:
Address:		E-mail:
City:	Zip:	FAX:
County:	Climatic Zone:	
COMPLIANCE DOCUMENTS	Check <input type="checkbox"/> the appropriate box	
	Plans	
	Specifications	
	Calculations	
	Checklists (Appendix A)	
	Other	
COMPLIANCE PATH	Check <input type="checkbox"/> the appropriate box	
	Mandatory	
	Prescriptive (or)	
	Energy Cost Budget (ECB)	
	ECB Design Energy Cost (\$/Yr.)	ECB Energy Cost Budget (\$/Yr.)
Description of HVAC System (s):		

Project:

TABLE 5.3.1 Building Envelope Requirements - Climatic Zone 1

Opaque Elements	Conditioned or Unconditioned Space			
	Assembly Maximum	Installed	Insulation Min. R-Value	Installed
<i>Roofs</i>				
Insulation Entirely above Deck	U-0.063		15.0 c.i.	
Metal Building	U-0.065		19.0	
Attic and Other	U-0.034		30.0	
<i>Walls, Above Grade</i>				
Mass	U-0.151		5.7 c.i.	
Metal Building	U-0.113		13.0	
Steel Framed	U-0.124		13.0	
Wood Framed and Other	U-0.089		13.0	
<i>Wall, Below Grade</i>				
Below Grade Wall	C-1.14		NR	
<i>Floors</i>				
Mass	U-0.107		6.3 c.i.	
Steel Joist	U-0.052		19.0	
Wood Framed and Other	U-0.051		19.0	
<i>Slab-on-Grade Floors</i>				
Unheated	F-0.730		NR	
Heated	F-1.020		7.5 for 12 in.	
<i>Opaque Doors</i>				
Swinging	U-0.700			
Non-Swinging	U-1.450			

Source - Table B-11 ASHRAE 90.1-2001

c.i. = Continuous Insulation

NR = Not Required

Project:

TABLE 5.3.1 Building Envelope Requirements - Climatic Zone 1, continued						
Fenestration	Conditioned or Unconditioned Space					
	Assembly Maximum U-Factor	Installed	Assembly Maximum SHGC			
			All Orientations	Installed	North Oriented	Installed
<b>Fixed Vertical Glazing</b>						
% of Wall						
0 - 10%	0.57		0.39		0.49	
10.1 - 40%	0.57		0.39		0.49	
40.1 - 50%	0.46		0.27		0.32	
<b>Operable Vertical Glazing</b>						
% of Wall						
0-10%	0.67		0.39		0.49	
10.1 - 40%	0.67		0.39		0.49	
40.1 - 50%	0.47		0.27		0.32	
<b>Skylight with Curb, Glass,</b>						
% of Roof						
0 - 2.0%	1.17		0.49			
2.1 - 5.0%	1.17		0.39			
<b>Skylight with Curb, Plastic</b>						
% of Roof						
0 - 2.0%	1.30		0.65			
2.1 - 5.0%	1.30		0.34			
<b>Skylight without Curb, all</b>						
% of Roof						
0 - 2.0%	0.69		0.49			
2.1 - 5.0%	0.69		0.39			
Source - Table B-11 ASHRAE 90.1-2001						
c.i. = Continuous Insulation						
NR = Not Required						

Project:

TABLE 5.3.2 Building Envelope Requirements - Climatic Zone 2				
Opaque Elements	Conditioned or Unconditioned Space			
	Assembly Maximum	Installed	Insulation Min. R-Value	Installed
<i>Roofs</i>				
Insulation Entirely above Deck	U-0.063		15.0 c.i.	
Metal Building	U-0.065		19.0	
Attic and Other	U-0.034		30.0	
<i>Walls, Above Grade</i>				
Mass	U-0.580		NR	
Metal Building	U-0.113		13.0	
Steel Framed	U-0.124		13.0	
Wood Framed and Other	U-0.089		13.0	
<i>Wall, Below Grade</i>				
Below Grade Wall	C-1.140		NR	
<i>Floors</i>				
Mass	U-0.137		4.2 c.i.	
Steel Joist	U-0.052		19.0	
Wood Framed and Other	U-0.051		19.0	
<i>Slab-on-Grade Floors</i>				
Unheated	F-0.730		NR	
Heated	F-1.020		7.5 for 12 in.	
<i>Opaque Doors</i>				
Swinging	U-0.700			
Non-Swinging	U-1.450			
Source - Table B-8 ASHRAE 90.1-2001				
c.i. = Continuous Insulation				
NR = Not Required				



Project:

TABLE 5.3.2 Building Envelope Requirements - Climatic Zone 2, continued

Fenestration	Conditioned or Unconditioned Space					
	Assembly Maximum U-Factor	Installed	Assembly Maximum SHGC			
			All Orientations	Installed	North Oriented	Installed
<b>Fixed</b> Vertical Glazing % of Wall 0 - 10%	1.22		0.39		0.61	
10.1 - 40%	1.22		0.25		0.61	
40.1 - 50%	1.22		0.15		0.38	
<b>Operable</b> Vertical Glazing % of Wall 0-10%	1.27		0.39		0.61	
10.1 - 40%	1.27		0.25		0.61	
40.1 - 50%	1.27		0.15		0.38	
<b>Skylight</b> with Curb, Glass, % of Roof 0 - 2.0%	1.98		0.39			
2.1 - 5.0%	1.98		0.19			
<b>Skylight</b> with Curb, Plastic % of Roof 0 - 2.0%	1.90		0.65			
2.1 - 5.0%	1.90		0.34			
<b>Skylight</b> without Curb, all % of Roof 0 - 2.0%	1.36		0.39			
2.1 - 5.0%	1.36		0.19			

Source - Table B-8 ASHRAE 90.1-2001

c.i. = Continuous Insulation

NR = Not Required

Project:

TABLE 5.3.3 Building Envelope Requirements - Climatic Zone 3

Opaque Elements	Conditioned or Unconditioned Space			
	Assembly Maximum	Installed	Insulation Min. R-Value	Installed
<i>Roofs</i>				
Insulation Entirely above Deck	U-0.063		15.0 c.i.	
Metal Building	U-0.065		19.0	
Attic and Other	U-0.034		30.0	
<i>Walls, Above Grade</i>				
Mass	U-0.580		NR	
Metal Building	U-0.113		13.0	
Steel Framed	U-0.124		13.0	
Wood Framed and Other	U-0.089		13.0	
<i>Wall, Below Grade</i>				
Below Grade Wall	C-1.140		NR	
<i>Floors</i>				
Mass	U-0.137		4.2 c.i.	
Steel Joist	U-0.052		19.0	
Wood Framed and Other	U-0.051		19.0	
<i>Slab-on-Grade Floors</i>				
Unheated	F-0.730		NR	
Heated	F-1.020		7.5 for 12 in.	
<i>Opaque Doors</i>				
Swinging	U-0.700			
Non-Swinging	U-1.450			
Source - Table B-6 ASHRAE 90.1-2001				
c.i. = Continuous Insulation				
NR = Not Required				

Project:

TABLE 5.3.3 Building Envelope Requirements - Climatic Zone 3, continued						
Fenestration	Conditioned or Unconditioned Space					
	Assembly Maximum U-Factor	Installed	Assembly Maximum SHGC			
			All Orientations	Installed	North Oriented	Installed
<b>Fixed</b> Vertical Glazing % of Wall 0 - 10%	1.22		0.39		0.61	
10.1 - 40%	1.22		0.25		0.61	
40.1 - 50%	1.22		0.17		0.42	
<b>Operable</b> Vertical Glazing % of Wall 0-10%	1.27		0.39		0.61	
10.1 - 40%	1.27		0.25		0.61	
40.1 - 50%	1.27		0.17		0.42	
<b>Skylight</b> with Curb, Glass, % of Roof 0 - 2.0%	1.98		0.39			
2.1 - 5.0%	1.98		0.25			
<b>Skylight</b> with Curb, Plastic % of Roof 0 - 2.0%	1.90		0.65			
2.1 - 5.0%	1.90		0.39			
<b>Skylight</b> without Curb, all % of Roof 0 - 2.0%	1.36		0.39			
2.1 - 5.0%	1.36		0.25			
Source – Table B-6 ASHRAE 90.1-2001 c.i. = Continuous Insulation NR = Not Required						

Project:

## 6. HEATING VENTILATING and AIR CONDITIONING

6.1.3 Simplified Approach Option for HVAC Systems. Each HVAC system in buildings two stories or less in height and with less than 25,000 ft<sup>2</sup> gross floor area that meet criteria of paragraph 6.1.3 shall be considered in compliance with the requirements of Section 6.

**TABLE 6.1.3**  
**Eliminate Required Economizer by Increasing Cooling Efficiency**

Unitary Systems with Heat Pump Heating				
System Size (kBtu/h)	Mandatory Minimum EER	Alabama Climatic Zone		
		Zone 1	Zone 2	Zone 3
		Minimum Cooling Efficiency Required (EER) <sup>a, b</sup>		
65 and <135	10.1	12.1	11.6	11.6
135 and 240	9.3	11.3	10.8	10.8
>240 and <760	9.0	10.9	10.5	10.5
Installed System Size (kBtu/h)		Installed Cooling Efficiency (EER) <sup>b</sup>		
Other Unitary Systems				
System Size (kBtu/h)	Mandatory Minimum EER	Alabama Climatic Zone		
		Zone 1	Zone 2	Zone 3
		Minimum Cooling Efficiency Required (EER) <sup>a, b</sup>		
65 and < 135	10.3	12.5	12.0	12.0
135 and 240	9.7	11.5	11.1	11.1
>240 and < 760	9.5	11.2	10.7	10.7
Installed System Size (kBtu/h)		Installed Cooling Efficiency (EER) <sup>b</sup>		
<sup>a</sup> Each EER shown should be reduced by 0.2 for units with a heating section other than electric resistance heat.				
<sup>b</sup> Tested in accordance with the references listed in Section 12 of ASHRAE 90.1-2001.				

Project:

6. HVAC, continued  
**Electrically Operated**  
**Air Conditioners, Condensing Units, Heat Pumps, PTAC, PTHP**  
**Efficiency Requirements**

<b>System #</b>	<b>Equipment Type Refer to Tables 6.2.1A,B, and D</b>	<b>No. of Units</b>	<b>Size Category</b>	<b>Heating Section Type</b>	<b>Sub-Category or Rating Condition</b>	<b>Minimum Efficiency<sup>a,b,c</sup> SEER EER IPLV COP</b>	<b>Installed Efficiency</b>
<b>1</b>							
<b>2</b>							
<b>3</b>							
<b>4</b>							
<b>5</b>							

<sup>a</sup> Single-phase, air-cooled air conditioners and heat pumps < 65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.

<sup>b</sup> Tested in accordance with the references listed in Section 12 of ASHRAE 90.1-2001.

<sup>c</sup> IPLV values are only applicable to equipment with capacity modulation.

Project:

6. HVAC, continued

**Water Chilling Packages - Minimum Efficiency Requirements**

<b>System #</b>	<b>Equipment Type Refer to Tables 6.2.1 C</b>	<b>No. of Units</b>	<b>Size Category</b>	<b>Minimum Efficiency<sup>a,b</sup> COP IPLV</b>	<b>Installed Efficiency</b>
<b>1</b>					
<b>2</b>					
<b>3</b>					
<b>4</b>					
<b>5</b>					
<sup>a</sup> The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is 40F. <sup>b</sup> Tested in accordance with the references listed in Section 12 of ASHRAE 90.1-2001.					

Project:

6.0 HVAC, Continued

**Gas- or Oil - Fired  
Warm Air Furnaces and Combination Warm Air Furnaces/Air Conditioner Units,  
Warm Air Duct Furnaces and Unit heaters**

<b>System #</b>	<b>Equipment Type Refer to Table 6.2.1E</b>	<b>No. of Units</b>	<b>Size Category</b>	<b>Sub-Category or Rating Condition</b>	<b>Minimum Efficiency AFUE Et Ec</b>	<b>Installed Efficiency</b>
<b>1</b>						
<b>2</b>						
<b>3</b>						
<b>4</b>						
<b>5</b>						
See footnotes of TABLE 6.2.1E ASHRAE 90.1-2001.						

Project:

## 6.0 HVAC, Continued

### Gas-and Oil-Fired Boilers - Minimum Efficiency Requirements

System #	Equipment Type Refer to Table 6.2.1F	No. of Units	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency AFUE Et Ec	Installed Efficiency
1						
2						
3						
4						
5						
See footnotes of TABLE 6.2.1F ASHRAE 90.1-2001.						



Project:

6.0 HVAC, Continued

**Performance Requirements for Heat Rejection Equipment (Cooling Towers)**

<b>System #</b>	<b>Equipment Type Refer to Table 6.2.1G</b>	<b>No. of Units</b>	<b>Total System Heat Rejection Capacity at Rated Conditions</b>	<b>Sub-Category or Rating Condition</b>	<b>Performance Required</b>	<b>Installed Performance</b>
<b>1</b>						
<b>2</b>						
<b>3</b>						
<b>4</b>						
<b>5</b>						
See footnotes of TABLE 6.2.1G ASHRAE 90.1-2001.						

Project:

**TABLE 7.2.2**

**Performance Requirements for Water Heating Equipment**

<b>Equipment Type</b>	<b>Size Category (Input)</b>	<b>Subcategory or Rating Category</b>	<b>Performance Required</b>	<b>Installed Performance</b>
See footnotes to Table 7.2.2 ASHRAE 90.1-2001				

Project:

**TABLE 9.3.1.1 Lighting Power Densities Using the Building Area Method**

<b>Building Area Type<sup>a</sup></b>	<b>Lighting Power Density (W/ft<sup>2</sup>)</b>	<b>Installed Lighting (W/ft<sup>2</sup>)</b>
Automotive Facility	1.5	
Convention Center	1.4	
Court House	1.4	
Dining: Bar Lounge/Leisure	1.5	
Dining: Cafeteria/Fast Food	1.8	
Dining: Family	1.9	
Dormitory	1.5	
Exercise Center	1.4	
Gymnasium	1.7	
Hospital/Health Care	1.6	
Hotel	1.7	
Library	1.5	
Motel	2.0	
Motion Picture Theater	1.6	
Multi-Family	1.0	
Museum	1.6	
Office	1.3	
Parking Garage	0.3	
Penitentiary	1.2	
Performing Arts Theater	1.5	
Police/Fire Station	1.3	
Retail	1.9	
School/University	1.5	
Sports Arena	1.5	
Transportation	1.2	
Warehouse	1.2	
Workshop	1.7	

a - In cases where both general building area type and a specific building area type are listed, the specific building area type shall apply.

**TABLE 9.3.2 Lighting Power Limits for Building Exteriors**

<b>Applications</b>	<b>Power Limits</b>	<b>Installed</b>
Building entrance with canopy or free standing canopy	3 W/ft <sup>2</sup> of canopied area	
Building entrance without canopy	33 W/lineal ft of door width	
Building exit	20 W/lineal ft of door width	